Introduction

Ample evidence has been presented on the distal and proximal factors that determine the full spectrum of alcohol use – from alcohol initiation to drinking – in adolescence and beyond (Ham and Hope, 2003; Kuntsche et al., 2004). However, an increasing number of longitudinal studies have demonstrated that proximal cognitive factors related to alcohol use are rooted in childhood (Schulenberg and Maggs, 2008). In childhood, parents are the principal socialization agents stimulating children’s development (Steinberg, 2002). Consequently, they are the primary source of their children’s alcohol-related knowledge (Zucker et al., 2008, 1995). The Cognitive Model of Intergenerational Transference (Campbell and Oei, 2010) assumes that parents’ verbal affirmations of the perceived benefits of alcohol and children’s observation of the effects of parental alcohol use are responsible for the intergenerational transference of alcohol-related cognitions, that is, what children a) know about alcohol (i.e., alcohol-related knowledge); b) know about alcohol use in adult culture (i.e., alcohol-related norms), and c) believe happens to others or themselves when drinking alcohol (i.e., alcohol expectancies).

A literature review conducted by Lang and Stritzke (1993) on children’s alcohol-related cognitions showed that children are not ‘innocent’ with respect to alcohol. Already at age three, children have alcohol-related knowledge, as they can recognize and identify alcoholic...
beverages. From age five on, children seem to be aware of age-related alcohol norms (e.g., only adults consume alcohol), hold sex-specific alcohol norms (e.g., males like alcohol-related activities more than do females), and know socially acceptable amounts of alcohol use (e.g., small versus large alcohol dose). Finally, as early as six years of age, children have certain alcohol expectancies that seem to shift from primarily negative to primarily positive by the age of ten. Based on observed situational determinants, children seem to acquire knowledge of alcohol itself and the role of alcohol in the social environment (i.e., norms) based on which they eventually develop alcohol expectancies (Zucker et al., 2008, 1995). In this respect, it is essential to evaluate what is already known regarding the developmental sequence from knowledge and norms to expectancies. Unfortunately, since the review by Lang and Stritzke (1993) conducted more than two decades ago did not follow guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Liberati et al., 2009; Moher et al., 2009), a comprehensive state-of-the-art knowledge of research on children’s alcohol-related cognitions is currently lacking. Besides, the impact of parental alcohol use on the acquisition of children’s alcohol-related cognitions was not considered in the previous review (Lang and Stritzke, 1993). It is crucial to understand this impact, as alcohol-related knowledge and alcohol-related norms are supposed to influence alcohol expectancies (e.g., ‘I expect that alcohol makes me sociable’) and the transition to drinking motives (e.g., ‘I drank for the first time to enjoy a party’). According to the Motivational Model of alcohol use (Cox and Klinger, 1990, 1988), the latter is thought to constitute the final pathway to alcohol initiation (Kuntsche and Müller, 2012) and subsequent drinking patterns (e.g., binge drinking) (Andrews et al., 2011; Donovan et al., 2004; Windle et al., 2008). Risky drinking among young people is particularly alarming, as childhood is a critical period of cortical development, and it is important for establishing lifelong adult characteristics, which drinking could disrupt (Crews et al., 2007). Therefore, this systematic review aimed to summarize the evidence of the impact of parental alcohol use on the acquisition of children’s alcohol-related cognitions (alcohol-related knowledge, alcohol-related norms, alcohol expectancies) in the developmental period from age two to ten. This particular age range was chosen to explore the development and increase of alcohol-related cognitions before adolescence. Scholars have suggested that the socialization into early alcohol use occurs before age ten (Zucker et al., 2008). This review builds on and extends the review of Lang and Stritzke (1993) by including studies published from 1976 to 2016 that focused on the acquisition of children’s alcohol-related cognitions and on the impact of parental alcohol use on this acquisition. Our review also adheres to PRISMA guidelines (Liberati et al., 2009; Moher et al., 2009), thus reporting the findings in a comprehensive and transparent manner.

2. Material and methods

A computer-assisted systematic literature search was performed in collaboration with an information expert in searches for systematic reviews and meta-analyses in PubMed, PsychINFO, ERIC, and EMBASE in accordance with the PRISMA guidelines (Liberati et al., 2009; Moher et al., 2009). The review was registered in the Prospero database of systematic reviews (registration number CRD42016051080). Inclusion criteria were: a) full-text original articles published in the last forty years (from 1976 to 2016) and written in English; b) studies including children in the developmental period from age two to ten; and c) studies assessing children’s alcohol-related knowledge, alcohol-related norms, and/or alcohol expectancies as outcomes only and/or in combination with parental alcohol use. The reviewed studies that comprised samples of children who were younger as well as older than the age of ten were included in the review. Of these studies, we only reviewed the results for the children within the age range between two and ten years (see Table 2 for specific information). Both explicit alcohol expectancies that rely on non-automatic cognitive motivational processes as well as implicit alcohol expectancies that rely on automatic underlying motivational processes were included (Thush and Wiers, 2007). Exclusion criteria were: a) full-text original articles published before 1976 and written in language other than English and b) commentaries, editorial notes, and study protocols. In addition, the reference sections of identified articles were cross-checked in order to find relevant articles meeting the above-mentioned inclusion criteria. If full-text articles were not available, we contacted their authors to obtain them.

2.1. Data selection process

Using a predefined scheme based on the PRISMA checklist (Moher et al., 2009), the following data were extracted from the 20 selected studies: a) study characteristics (i.e., author(s) and year of publication); b) methods (i.e., sample characteristics, sampling strategy, study design, and outcomes); c) results (i.e., main results), and d) conclusions. The risk of bias of the selected studies was evaluated using the Newcastle Ottawa Scale (NOS) (Wells et al., 2000), a widely used tool for assessing the quality of observational studies (Stang, 2010) that has been adapted for cross-sectional studies (Herzog et al., 2013).

3. Results

Table 1 provides an overview of the characteristics of the 20 selected studies in this systematic review. Of the 20 studies, 16 focused on children’s alcohol-related knowledge (Austin and Nach-Ferguson, 1995; Casswell et al., 1988; Dalton et al., 2005; Flett et al., 1987; Fossey, 1993a, 1993b; Gaines et al., 1988; Greenberg et al., 1985; Hahn et al., 2000; Jahoda et al., 1980; Kuntsche et al., 2016; Mennella and Garcia, 2000; Noll et al., 1990; Tennant, 1979; Valentine et al., 2014; Zucker et al., 1995), five focused on children’s alcohol-related norms (Jahoda et al., 1980; Kuntsche et al., 2016; Noll et al., 1990; Spiegler, 1983; Zucker et al., 1995), four focused on children’s explicit alcohol expectancies (Austin and Nach-Ferguson, 1995; Flett et al., 1987; Kuntsche, 2017; Mares et al., 2015), and one focused on both explicit and implicit alcohol expectancies (Pieters et al., 2010). Eleven focused on the impact of parental alcohol use on the acquisition of children’s alcohol-related cognitions (Casswell et al., 1988; Dalton et al., 2005; Gaines et al., 1988; Greenberg et al., 1985; Hahn et al., 2000; Jahoda et al., 1980; Mares et al., 2015; Mennella and Garcia, 2000; Noll et al.,
Children (aged 3.0-6.0) could distinguish between alcoholic and non-alcoholic beverages. In addition, children could identify the content of alcoholic beverages and knew its use in adult references in alcohol-related knowledge and alcohol-related norms were found.

C. Voogt et al. (2017) 198 children aged 4.0-6.0 (of which 19.2 aged 4.0, 43.4% aged 5.0, and 37.4% aged 6.0) recruited using a random sampling strategy; mean age is unknown; 47.0% boys; cross-sectional study; Switzerland.

Concerning alcohol-related knowledge, children identified 68.1% of the beverages as alcohol-containing and 83.2% as non-alcohol containing. They knew 46.6% and 73.1% of the alcoholic and non-alcoholic beverages by name. No sex differences were found in alcohol-related knowledge, yet the knowledge increased with age. Concerning alcohol-related norms, children assigned alcoholic beverages more often to males (42.2%) compared to females (28.7%) or children (12.7%) and adults were more often assigned alcoholic beverages at a party (39.4%) rather than when playing outdoors (34.7%). Sex and age differences in alcohol-related norms revealed that a) girls and older children assigned alcoholic beverages to children less often compared to boys and younger children and b) older children assigned alcoholic beverages to males more often compared to younger children.

Children (aged 3.0-6.0) had higher positive rather than negative explicit AE. No age differences for explicit AE factors emerged, yet sex differences indicated that girls had more positive explicit AE compared to boys.

Table 1
Study characteristics, methods, results, and conclusions of 20 selected studies ordered chronologically from the most recent.

<table>
<thead>
<tr>
<th>Study (year)</th>
<th>Methods</th>
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<tr>
<td>Kuntsche (2017)</td>
<td>Number of participants: age range of participants; sampling strategy; mean age (SD) of participants; % of boys; study design; country</td>
<td>Children’s explicit AE (4 factors: annual-positive, annual-negative, sedation-positive, sedation-negative) and demographic characteristics (sex, age). The outcomes were measured by the Berkeley Puppet Interview in which 2 identical dog hand puppets made opposing statements about different opinions (e.g., ‘I think when adults drink alcohol, they become happy’ versus ‘I think when adults drink alcohol, they do not become happy’). Children were asked ‘And how about you, what do you think?’ The puppet with which the child agrees then repeats the child’s answer, thereby appraising the child’s answer. Trained interviewers administered responses individually.</td>
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<tr>
<td>Kuntsche et al. (2016)</td>
<td>Number of participants: age range of participants; sampling strategy; mean age (SD) of participants; % of boys; study design; country</td>
<td>Children’s alcohol-related knowledge, alcohol-related norms, and demographic characteristics (sex, age). The outcomes were measured using the eABT that presents 11 everyday life scenarios on a touch-screen computer. Children were asked a) to indicate what the displayed male and female adults and children drank by touching 1 of the 12 displayed beverages (4 alcoholic; 8 non-alcoholic), b) whether the beverages contain alcohol, and c) whether they know the names of the beverages.</td>
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<tr>
<td>Mares et al. (2015)</td>
<td>Number of participants: age range of participants; sampling strategy; mean age (SD) of participants; % of boys; study design; country</td>
<td>Children’s explicit AE (positive and negative) and demographic characteristics (sex, age). Parents reported on alcohol use. Children’s outcomes were measured using the Berkeley Puppet Interview in which 2 identical dog hand puppets made opposing statements. Children were asked ‘And how about you, what do you think?’. The puppet with which the child agrees then repeats the child’s answer, thereby appraising the child’s answer. Trained interviewers administered responses.</td>
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<td>Valentine et al. (2014)</td>
<td>Number of participants: age range of participants; sampling strategy; mean age (SD) of participants; % of boys; study design; country</td>
<td>Ten families consisting of 18 children aged 5.0–12.0 (of which 55.6% young and 44.4% old) recruited using a random sampling strategy; case study; United Kingdom.</td>
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<td>Pieters et al. (2010)</td>
<td>99 children aged 9.0-12.0 (of which 23.0% non-drinkers and 67.0% drinkers) recruited using a convenience sampling strategy; 10.2 (SD = 0.45) years old; 55.0% boys; cross-sectional study; the Netherlands.</td>
<td>Children's explicit AE (positive and negative), implicit AE, and perceived parental alcohol use. Children's explicit AE (modified version of the AE Scale for Children) and their perceived parental alcohol use ('Did your father/mother drink beer or wine last week? with answers categories: 1 = no, 2 = once, 3 = a couple of times, 4 = every day') were measured by self-administered surveys in a classroom guided by trained research assistants. Children's implicit AE were measured by a modified version of the IAT in which 16 colored pictures of beverages (8 alcoholic; 8 soda) and 16 colored pictures of faces of children (8 happy; 8 angry) were presented on a computer. Children were asked to pick the pictures that correspond to the faces.</td>
<td>of the legal age for public consumption and the legal purchase age. Moreover, they were aware of some of the short-term health risks and social harms associated with drinking, including that alcohol: affects children more rapidly than adults; has physical effects on the body and social effects on behavior, and increases a risk of addiction. Children had positive and negative explicit AE and negative implicit AE. Concerning explicit AE, children did not differ in the degree to which they expected negative effects of alcohol use, yet drinkers anticipated more positive effects of alcohol use compared to non-drinkers. Concerning implicit AE, both drinkers and non-drinkers associated alcohol more strongly with angry faces than with happy faces. Perceived parental alcohol use was not related to children's explicit and implicit AE. Children (aged 9.0-12.0) had positive and negative explicit AE and negative implicit AE. In addition, perceived parental alcohol use was not related to children's explicit and implicit AE.</td>
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<td>Dalton et al. (2005)</td>
<td>120 children aged 2.0-6.0 (of which 30.0% minority and 70.0% non-minority) recruited using a convenience sampling strategy; mean age is unknown; 45.0% boys and 199 parents aged ≤ 290-49.0; 5.8% boys and 126 parents; cross-sectional study; United States.</td>
<td>Children's alcohol-related knowledge (purchases and identification of grocery products). Parents reported on alcohol use, children's movie exposure, and demographic characteristics. Children's outcomes were measured using a role-playing scenario involving grocery shopping and a social event for adults guided by a researcher. Parental outcomes were measured using self-administered surveys.</td>
<td>Children's alcohol-related knowledge was not related to parental alcohol use and children's movie exposure: children were more likely to purchase alcohol a) when their parents reported drinking alcohol at least monthly compared to those who reported drinking alcohol less than monthly; b) as their viewing of movies rated for older audiences increased; c) if children watched PG-13- or R-rated movies compared with those who watched only G-rated movies infrequently. Children (aged 2.0-6.0) purchased alcohol and could identify the type of alcohol. Children's alcohol purchases were related to parental alcohol use and children's movie exposure. Children (aged 9.0-12.0) purchased alcohol and could identify the type of alcohol. Children's alcohol purchases were related to parental alcohol use and children's movie exposure. Children (aged 5.0-6.0) could identify alcoholic beverages, yet this alcohol-related knowledge was not related to parental alcohol use. No sex and ethnic differences were found for alcohol-related knowledge.</td>
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<td>Hahn et al. (2000)</td>
<td>126 children aged 5.0-6.0 recruited using a random sampling strategy; 5.8 (SD = 0.40) years old; 44.0% boys and 126 parents; 32.4 (SD = 8.90) years old; 3.2% fathers; cross-sectional study; United States.</td>
<td>Children's alcohol-related knowledge and demographic characteristics (sex, ethnic group). Parents reported on alcohol use and demographic characteristics (income, marital status). Children's outcomes were measured by the CDAL, a pictorial inventory consisting of 18 pictures (6 neutral; 12 related to alcohol, tobacco, or other drugs) administered by trained interviewers at school. A child bear is depicted together with a parent bear who performs different tasks. Trained interviewers administered responses individually.</td>
<td>Children (aged 5.0-6.0) could identify alcoholic beverages, yet this alcohol-related knowledge was not related to parental alcohol use. No sex and ethnic differences were found for alcohol-related knowledge.</td>
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<td>Mennella and Garcia (2000)</td>
<td>150 children aged 3.8-6.0 (of which 20.0% lived in a household in which 1 or both parents were escape drinkers = 'escape group' and 50.7% who had no escape drinking mother or father = 'no escape group'). Children's alcohol-related knowledge (odor preferences and identification). Parents reported on alcohol use and reasons for drinking. Children's outcomes were measured using an age-related pictorial inventory consisting of 18 pictures (6 neutral; 12 related to alcohol, tobacco, or other drugs) administered by trained interviewers at school. A child bear is depicted together with a parent bear who performs different tasks. Trained interviewers administered responses individually.</td>
<td>Concerning odor preferences, children preferred bubble gum (86.0%), followed by mineral oil (66.0%), beer (52.7%), and pyridine (11.3%), respectively. Children in the 'escape group' were more likely to pick the pictures that correspond to alcoholic beverages compared to the 'no escape group'. A) Children (aged 3.8-6.0) had alcohol-related knowledge, which is based on sensory experiences and experiences at home and the emotional context in which their parents.</td>
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Children's alcohol-related knowledge was considered as considerable, as they obtained a mean score of a) 6.3 (SD = 2.1) for general knowledge, b) 5.9 (SD = 1.9) for brand-specific knowledge, and c) 4.9 (SD = 1.9) for specific alcoholic beverages. Concerning odor identification, children most often correctly identified the odor of gum (48%), followed by beer (33%) and spoiled milk (22%).

Study (year) | Methods | Outcomes | Conclusions
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Austin and Nach-Ferguson (1995) | Children (aged 7-12.0) were recruited using a convenience sampling strategy; mean age is unknown; 47.4% boys; children (aged 5.5-12.0) could distinguish between alcoholic and non-alcoholic beverages. This knowledge increased with age. Moreover, CAOs had more alcohol-related knowledge and alcohol-related norms than did NCAOs. | Children's alcohol-related knowledge and alcohol-related norms, and demographic characteristics (age). Fathers reported on alcohol use. | Children's outcomes were measured using a modified version of the ABT in which 10 everyday life drawings are shown on a table. In every drawing, each character is drinking an unidentified beverage. Children were asked a) to indicate what the male and female adults and children drank in each drawing by pointing 1 of the 10 beverages and b) whether they know the name of the beverage. The parental outcome was measured using a self-administered paper-and-pencil survey by adults. |
Zucker et al. (1995) | Children (aged 5.5-10.5) were recruited using a convenience sampling strategy; mean age is unknown; 38% were CAOs and 38% were NCOAs; boys (53.1%) and girls (46.9%) were equally represented. | The outcomes were measured using a modified version of the ABT in which children attempt to identify alcoholic beverages by smell. The outcomes were measured using a self-administered paper-and-pencil survey by adults. | Children's alcohol-related knowledge and alcohol-related norms, and demographic characteristics (age). Fathers reported on alcohol use. |
Concerning alcohol-related knowledge, older children were better at identifying substances by smell compared to younger children in the 1st trial. Of the older children, 57% identified beer, wine, or whiskey correctly compared to 41% of the younger children. Children aged 5.5–6.5 were more likely to report that they knew nothing about alcohol compared to children aged 9.5–10.5. Of the 5.5–6.5 year olds, factual information about alcohol was reported more often compared to negative information about alcohol. Factual and negative information about alcohol increased with age.

Children aged 5.5–6.5 could tell factual (‘alcohol make you drunk’) and negative information (‘alcohol is bad for you’) about alcohol. This alcohol-related knowledge started at age 5.5–6.5 and increased with age.

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<td>Noll et al. (1990)</td>
<td>57 children (of which 51.0% aged 2.6–4.0 and 49.0% aged 4.1–5.8) aged 2.5–6.0 recruited using a convenience sampling strategy; mean age is unknown; 49.6% boys; cross-sectional study; United States.</td>
<td>Children’s alcohol-related knowledge, alcohol-related norms, and demographic characteristics (sex, age). Parents reported on alcohol use and demographic characteristics. Children’s outcomes were measured using a smelling task in which children attempted to identify alcoholic beverages based on smell (1st uncued trial) and by pointing to a picture of the substances that were not correctly identified on the 1st trial (2nd used trial). In the first trial, 9 jars with different odors (3 substances mainly used by children or by both children and adults = ‘universal-use’; apple juice, Play-doh, popcorn; 2 substances mainly used by adults = ‘non-controlled adult-use’; coffee, perfume; 4 substances whose use is legally limited to adults only = ‘controlled adult-use’; beer, whiskey, wine, cigarettes) were presented. Children were asked a) to identify what they smelled. In the second trial, 9 color photographs were presented. The responses were administered individually by trained examiners. Parental outcomes were measured using self-administered surveys.</td>
<td>Children’s alcohol-related knowledge, alcohol-related norms are unknown. Moreover, parental alcohol use was related to children’s ability to identify ≥ 1 alcoholic beverages. Those who were most successful at identifying ≥ 1 alcoholic beverage came from families in which both parents reported alcohol use. No sex differences in alcohol-related knowledge and alcohol-related norms emerged. Of the children, 6% knew nothing about alcohol effects; 94% gave ≥ 1 response; 37% reported short-term effects, and 38% long-term effects. ‘Getting drunk’ was most often reported (71%). In addition, children’s sources of alcohol-related knowledge were television (35%), parents or children’s social environment.</td>
<td>Children (aged 2.6-6.0) could identify alcoholic beverages based on smell: this alcohol-related knowledge started at age 3.0–4.0 and increased with age. No sex differences emerged in alcohol-related knowledge and alcohol-related norms.</td>
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<td>Casswell et al. (1998)</td>
<td>743 children aged 8.0–9.0 recruited using a random sample strategy; mean age is unknown; 52.8% boys; and 740 mothers; cross-sectional study; New Zealand.</td>
<td>Children’s alcohol-related knowledge. Mothers reported on their own and partner’s alcohol use and alcohol-related problems in the ir children’s social environment. Children’s and maternal outcomes were measured using structured interviews administered by trained interviewers.</td>
<td>Concerning alcohol-related knowledge, older children were better at identifying substances by smell compared to younger children in the 1st trial. Of the older children, 57% identified beer, wine, or whiskey correctly compared to 41% of the younger children. Children aged 5.5–6.5 were more likely to report that they knew nothing about alcohol compared to children aged 9.5–10.5. Of the 5.5–6.5 year olds, factual information about alcohol was reported more often compared to negative information about alcohol. Factual and negative information about alcohol increased with age.</td>
<td>Children (aged 8.0-9.0) could describe the effects of alcohol and know the concept drunkenness. Television was the major source of alcohol-related knowledge.</td>
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Children (5- and 8-year olds) had knowledge about adult’s drinking motives, the amount of a small or large amount of wine and whiskey, and the places where adults knew about alcoholic beverage consumption. Sex and age differences in knowledge indicated that girls and 8-year-olds knew more about adults’ drinking motives compared to 5-year-olds. Parental alcohol use was only related to alcohol-related knowledge concerning adults’ drinking motives.

The mean number of days a year on which children had seen either parent drinking were 107.7 (SD = unknown) and 96.4 (SD = unknown) for 5- and 8-year olds, respectively. Most children were not aware of the legal age for public consumption. Sex and age differences in knowledge concerning the legal age for public consumption and no more than 20% guessed the legal purchase age between 17-20 years. The 8-year olds knew more about they knew this, and the meaning of being drunk.

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<td>Gaines et al. (1980)</td>
<td>Sample: 80 children in kindergarten (5-year old), grade 3 (8-year old), and grade 6 (11-year old), and grade 8 (13-year old).</td>
<td>Children’s alcohol-related knowledge (adult’s drinking motives, society rules and drinking constraints) and demographic characteristics (age). Parental outcomes were measured using telephone interviews.</td>
<td>The mean number of days a year on which children had seen either parent drinking were 107.7 (SD = unknown) and 96.4 (SD = unknown) for 5- and 8-year olds, respectively. Most children were not aware of the legal age for public consumption. Sex and age differences in knowledge concerning the legal age for public consumption and no more than 20% guessed the legal purchase age between 17-20 years. The 8-year olds knew more about they knew this, and the meaning of being drunk.</td>
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Greenberg et al. (1985) | Sample: 743 children aged 9-12 recruited using a random sample strategy. | Children’s alcohol-related knowledge and explicit alcohol and non-alcoholic beverage preferences. | The mean number of days a year on which children had seen either parent drinking were 107.7 (SD = unknown) and 96.4 (SD = unknown) for 5- and 8-year olds, respectively. Most children were not aware of the legal age for public consumption. Sex and age differences in knowledge concerning the legal age for public consumption and no more than 20% guessed the legal purchase age between 17-20 years. The 8-year olds knew more about they knew this, and the meaning of being drunk. |
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<td>Spiegler (1983)</td>
<td>60 children (of which 20.0% aged 5.5-6.5; 20.0% aged 6.5-7.5; 20.0% aged 7.5-8.5; 20.0% aged 8.5-9.5; and 20.0% aged 9.5-10.5) aged 5.5-10.5 recruited using a convenience sampling strategy; mean age is unknown; 50.0% boys; cross-sectional study; United States.</td>
<td>Children's alcohol-related norms and demographic characteristics (sex, age). The outcomes were measured using a pictorial interview consisting of 24 photographs (4 with alcohol: drinking beer, drinking whiskey, going to a bar, being drunk; 19 with eating food or drinking non-alcoholic beverages, and 1 with smoking) showing activities that people can do. Children were shown a box with 4 compartments ('like very much', 'like a little', 'dislike a little', 'dislike very much') and a picture of a same-sex child/male/female in front of the box. Children were asked to put the photograph in the box that asked how do they think a boy/girl/male/female like them/their father/their mother or like the boy/male/female in the picture feels about doing these activities.</td>
<td>Children (aged 5.5–10.5) acquired alcohol-related norms as early as age 6. No sex differences were observed, yet age differences in alcohol-related norms were noted.</td>
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<td>Jahoda et al. (1980)</td>
<td>113 children (of which 32.7% aged 4.0–5.6; 35.4% aged 5.7–6.6; and 31.9% aged 6.7–7.6) aged 4.0–7.6 recruited using a convenience sample strategy; mean age is unknown; 52.2% boys; and 113 parents; cross-sectional study; United States.</td>
<td>Children's alcohol-related knowledge, alcohol-related norms, and demographic characteristics. Parents reported on alcohol use and demographic characteristics. Children's outcomes were measured using a pictorial interview consisting of 12 color photographs of bottles (6 alcoholic; 6 non-alcoholic), and 4 drawings (boy, girl, male, female engaged in the act of drinking). The bottle photographs were shown on a table. Children were asked to a) choose 3 bottle photographs, which contained the beverages the person depicted in the drawing would like the most, b) name each bottle photograph that was shown in a random order, and c) explain the difference between the alcohol and non-alcohol grouping of the bottle photographs. The responses were administered individually by student assistants. Parental outcomes were measured using self-administered surveys.</td>
<td>Concerning alcohol-related knowledge, about half of the 4.0-5.6 year olds correctly named an ‘alcohol’ label to the bottle photographs and about half of them correctly explained the differences between the alcohol and non-alcohol grouping of the bottle photographs. Concerning alcohol-related norms, more than 1/3 of the 4.0-5.6 year olds reported that adults prefer alcoholic beverages and children prefer non-alcoholic beverages. No sex differences in alcohol-related knowledge and alcohol-related norms emerged, yet age differences showed that 6.7-7.6 year olds had more knowledge about alcohol and its norms compared to the younger children. In addition, parental alcohol use was not related to children's alcohol-related knowledge and alcohol-related norms.</td>
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Table 1 shows the results of the critical appraisal of the 20 selected studies. The quality of the studies ranged from two to seven stars on the ten-stars NOS (Herzog et al., 2013), with a median score of 4.5 stars. Concerning sample selection, eight studies used a random sampling strategy and seven studies had an acceptable sample size with more than two hundred participants. In addition, 19 of the 20 studies failed to report the comparability between the respondents and non-respondents’ characteristics, which may imply self-selection bias. Moreover, four studies used a validated measurement tool to assess children’s alcohol-related cognitions and most studies did not control for confounders (e.g., demographic characteristics) in their analyses. With respect to the outcomes, all studies used self-report measures, which can lead to information bias. In addition, all studies published since the 1990s described clearly the statistical tests used to analyze the data and reported p-values used to determine the statistical significance. Overall, the quality of the selected studies was considered moderate in this systematic review.

### 3.1. Children’s alcohol-related cognitions

#### 3.1.1. Alcohol-related knowledge

The 16 studies that focused on children’s alcohol-related knowledge indicated that children as young as age two start to acquire knowledge of alcohol. Of these 16 studies, a) eleven revealed that children (aged 2.0–10.0) can distinguish between alcoholic and non-alcoholic beverages based on smell (Fossey, 1993a; Gaines et al., 1988; Mennella and Garcia, 2000; Noll et al., 1990; Valentine et al., 2014), photographs (Austin and Nach-Ferguson, 1995; Hahn et al., 2000; Jahoda et al., 1980; Kuntsche et al., 2016; Zucker et al., 1995), or a role-playing scenario involving grocery shopping (Dalton et al., 2005). b) One study revealed that from age five and half on, children can tell factual (‘alcohol makes you drunk’) and negative (‘alcohol is bad for you’) information about alcohol (Fossey, 1993b). c) Three studies revealed that from age five on, children can describe the effects of alcohol (e.g., getting drunk, having accidents) (Casswell et al., 1988; Flett et al., 1987; Tennant, 1979), and d) one study revealed that from age five on, children know adults’ drinking motives, drinking places, and the quantity of a small or large amount of wine and whiskey (Gaines et al., 1988). Of the seven studies that examined sex differences in alcohol-related knowledge, two revealed that girls had more knowledge compared to boys (Austin and Nach-Ferguson, 1995; Gaines et al., 1988), yet five studies revealed no sex differences (Hahn et al., 2000; Jahoda et al., 1980; Kuntsche et al., 2016; Noll et al., 1990; Tennant, 1979). All nine studies that examined age differences in alcohol-related knowledge revealed that the knowledge of alcohol increased with age (Austin and Nach-Ferguson, 1995; Fossey, 1993a, 1993b; Gaines et al., 1988; Greenberg et al., 1985; Jahoda et al., 1980; Kuntsche et al., 2016; Noll et al., 1990; Zucker et al., 1995).
Table 2
Results of the critical appraisal of the 20 selected studies.

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<th>Author's</th>
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Note: "This study used a case study design, while the other 19 studies used cross-sectional study designs. NA: Not applicable. "1) Truly representative of the average in the target population (all participants or random sampling), 2) Somewhat representative of the average in the target population (non-random sampling), 3) Selected group of users, 4) No description of the sampling strategy; "1) Justified and satisfactory, 2) Not justified; "1) Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory, 2) The response rate is unsatisfactory, or the comparability between respondents and non-respondents is unsatisfactory, 3) No description of the response rate or the characteristics of the respondents and the non-respondents; "1) Validated measurement tool, 2) Non-validated measurement tool, but the tool is available or described, 3) No description of the measurement tool; "1) The study controls for the most important factor (select one), 2) The study controls for any additional factor; "1) Independent blind assessment, 2) Record linkage, 3) Self-report, 4) No description; "1) The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p-value); 2) The statistical test is not appropriate, not described or incomplete."
3.1.2. Alcohol-related norms

The five studies that focused on children’s alcohol-related norms indicated that children as young as age four have knowledge of alcohol use in adult culture. For instance, children (aged 2.9–10.0) assigned alcoholic beverages more often to males (Kuntsche et al., 2016; Zucker et al., 1995) and perceived males as liking alcohol-related activities more often (Spiegler, 1983) compared to females and children. Children (aged 2.6–7.0) also reported that alcoholic beverages, such as beer, wine, or whiskey, are consumed by adults only (Noll et al., 1990) and that adults prefer alcoholic beverages while children prefer non-alcoholic beverages (Jahoda et al., 1980). Besides having knowledge of these sex-specific and age-related alcohol norms, children (aged 3.0–6.0 years) can indicate that adults drink in specific situations. For example, adults were more often assigned alcoholic beverages at a party rather than when playing outdoors (Kuntsche et al., 2016). Of the four studies that examined sex differences in alcohol-related norms, only one study revealed that girls had more knowledge of alcohol-related norms compared to boys, as they less often assigned alcoholic beverages to children (Kuntsche et al., 2016). The other three studies did not find any sex differences in children’s alcohol-related norms (Jahoda et al., 1980; Noll et al., 1990; Spiegler, 1983). All four studies that examined age differences in alcohol-related norms revealed that knowledge of alcohol use in adult culture increased with age (Jahoda et al., 1980; Kuntsche et al., 2016; Spiegler, 1983; Zucker et al., 1995).

3.1.3. Alcohol expectancies

Of the five studies that focused on children’s alcohol expectancies, two revealed that children, from age six on, have positive explicit alcohol expectancies (e.g., ‘I think adults become friendly when they drink alcohol’) (Mares et al., 2015; Pieters et al., 2010). Four studies revealed that children, from age six on, have negative explicit alcohol expectancies (e.g., ‘I think adults become mean when they drink alcohol’) (Austin and Nach-Ferguson, 1995; Flett et al., 1987; Mares et al., 2015; Pieters et al., 2010). One study revealed that children, from age four on, have higher positive rather than negative explicit alcohol expectancies (Kuntsche, 2017). Lastly, one study indicated that children, from age nine on, have negative implicit alcohol expectancies, as they associated alcohol more strongly with angry faces rather than with happy faces (Pieters et al., 2010). The two studies that examined sex and age differences in explicit alcohol expectancies showed opposite effects. A recent Dutch study showed that boys and girls had equally strong positive and negative explicit alcohol expectancies, yet older children had less positive and more negative explicit alcohol expectancies compared to younger children (Mares et al., 2015). In contrast, a recent Swiss study showed that girls have more positive explicit alcohol expectancies compared to boys, yet no age differences emerged...
The evidence of the impact of parental alcohol use on the acquisition of children’s alcohol-related cognitions should be interpreted with caution due to methodological flaws of the selected studies in this systematic review. First, evidence is limited (i.e., only 20 studies were conducted in the past forty years), outdated (i.e., only 6 out of 20 studies were conducted after the year 2000), and comes almost exclusively from the United States (i.e., 11 out of 20 studies). Therefore, the degree to which the reported findings still apply today and the degree to which they apply to a broader cultural context remains unclear. The methodological challenges encountered when studying this population with limited reading and/or writing skills and undeveloped language skills that can be easily influenced by the researcher or by the ways in which questions are phrased might explain this undeveloped area of research on children’s alcohol-related cognitions (Dalton et al., 2005). Besides, age-appropriate measurement tools for children tend to be costly and time and labor-intensive (Kuntsche and Zucker, 2016). Nonetheless, these methodological challenges do not justify the lack of knowledge of the development of children’s alcohol-related cognitions.

Another explanation for the undeveloped area of research on children’s alcohol-related cognitions is the low prevalence of alcohol use among children (Zucker et al., 2009). Since most children start to drink alcohol during adolescence (Monshouwer et al., 2007; Van Dorsselaer et al., 2010), alcohol prevention and policies are mainly focusing on this age period. Scholars have argued, for instance, that postponing the age of alcohol initiation is crucial to prevent risky drinking and alcohol-related problems in adolescence and later in life (DeWit et al., 2000; Gruber et al., 1996; Hingson et al., 2000; Pirkkänen et al., 2005). Although alcohol prevention should start early (Zucker, 2008), not much is known about what ‘early’ actually means. This is because the vast majority of studies on alcohol have been conducted among drinkers. Second, all evidence was obtained from cross-sectional study designs, which largely restricts conclusions about the causal impact of parental alcohol use on the acquisition of children’s alcohol-related cognitions. Third, most evidence was collected from non-representative samples recruited through convenience sampling strategies that enhance the risk of selection bias, which is a systematic error in the deliberate selection of study participants (Kunz et al., 2007). Selection bias impairs the external validity, that is, the extent to which study findings can be generalized to other situations and populations. Safeguarding the external validity by using representative samples recruited through random sampling strategies is important particularly in the underdeveloped area of research on children’s alcohol-related cognitions to ascertain that study findings can be applied to a broader cultural context. Finally, no studies were identified that focused on the possible role of genetics in the acquisition of alcohol-related cognitions within the family context. Family, twin, and adoption studies have convincingly demonstrated that genes play an important role in the development of alcohol misuse and dependence, with heritability estimates in the range...
of 50% to 60% for both males and females (McGue, 1999). Although genetic factors have been found to be important mostly for the increase in drinking once initiated (Agrawal et al., 2012; Dick, 2011; Kuntsche et al., 2004), they may indirectly influence the observational learning process by providing more opportunities for the child to learn alcohol-related cognitions when he or she has a parent who is more genetically prone towards alcohol use. Thus, even though genes may be less relevant for the child’s alcohol cognitions, as opposed to the child’s progression to more advanced drinking habits once initiated later in life (Kuntsche et al., 2004), future research efforts could explore the role of genetics in the acquisition of alcohol-related cognitions.

In sum, the research on children’s alcohol-related cognitions is quite undeveloped. Moreover, empirical evidence of the role of exposure to (or visibility of) parental alcohol use in the acquisition of children’s alcohol-related cognitions is missing in contemporary literature. To further contribute to the development of theories that would explain young people’s alcohol initiation and precursors of risky drinking that contribute to the increased mortality in late adolescence and young adulthood (Rehm et al., 2001), future studies should explore the role of exposure to parental alcohol use in the acquisition of children’s alcohol-related knowledge and alcohol-related norms as basis for alcohol expectancies, as well as the transition from drinking motives to alcohol initiation and subsequent use. Additionally, the role of siblings and extended family members in this regard deserves attention, as parental influences are not necessarily synonymous with family influences. If families consist of more than parents and one child, the exposure to alcohol should ideally be measured within the broader family context. For this purpose, future longitudinal studies should use age-appropriate measurement tools and representative samples of children and early adolescents. The widespread availability of computer technology and the Internet provides opportunities to develop electronic and cost-effective measurement tools for children (e.g., touch-screen tablets) and early adolescents (e.g., online surveys) that would be easy to implement. This would also allow us to determine whether lower alcohol exposure by parents, but also by siblings and other extended family members, is an important factor that could be incorporated into prevention programs for children and young adolescents and their parents to significantly contribute to primary prevention.

Conflict of interest

All authors declare that they have no conflict of interest.

Contributors

CV was responsible for the literature search, the data selection and extraction process, the critical appraisal, and writing the manuscript. EK and MB also contributed to the literature search and the data selection process, respectively. MK, RO, RE, KS, and EK reviewed drafts of and revisions to the manuscript and contributed to writing. All authors contributed to and have approved the final manuscript.

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References


