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# A scoping review on the epidemiology, diagnostics, and clinical significance of porcine astroviruses

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# A scoping review on the epidemiology, diagnostics, and clinical significance of porcine astroviruses

## **Abstract**

Astroviruses (AstVs) are non-enveloped, 28-30 nm, positive-sense, single-stranded RNA viruses with a genome that varies from 6.4 to 7.3 kb. Astroviruses have been demonstrated to infect a wide variety of animals, both domestic and wild, including avian and mammalian species in terrestrial and aquatic environments.<sup>1</sup> Despite the broad host range and ability to cause disease, there are significant gaps in knowledge concerning the epidemiology, ecology, and pathophysiology of most AstVs.

## **Disciplines**

Large or Food Animal and Equine Medicine | Veterinary Infectious Diseases | Veterinary Preventive Medicine, Epidemiology, and Public Health

## Title

**A scoping review on the epidemiology, diagnostics, and clinical significance of porcine astroviruses**

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### **Contributions**

G. Rawal contributed to the development of all parts of the manuscript. A. O'Connor, B. Arruda and D. Linhares assessed the adequacy of scoping review and reviewing of manuscript.

### **Amendments**

NA

### **Support**

This project had no external funding support.

### **Introduction**

Astroviruses (AstVs) are non-enveloped, 28-30 nm, positive-sense, single-stranded RNA viruses with a genome that varies from 6.4 to 7.3 kb. Astroviruses have been demonstrated to infect a wide variety of animals, both domestic and wild, including avian and mammalian species in terrestrial and aquatic environments.<sup>1</sup> Despite the broad host range and ability to cause disease, there are significant gaps in knowledge concerning the epidemiology, ecology, and pathophysiology of most AstVs.

Porcine astroviruses (PoAstVs) are distributed worldwide.<sup>2</sup> PoAstVs are genetically diverse and conventionally assigned to five genetic lineages (PoAstV1-PoAsV5) reflecting diverse origins, interspecies transmission, and recombination events, some apparently with human strains.<sup>3-6</sup>

Astrovirus infections are considered to be the second most common causes of gastroenteritis in children<sup>7</sup>, but in animals their association with enteric diseases is not well characterized, with the exception of turkey<sup>8</sup> and mink<sup>9</sup> astrovirus infections. Apart from being enteric pathogens, astroviruses have also been linked to central nervous system (CNS) disease in humans<sup>10</sup>, cattle<sup>11</sup>, mink<sup>12</sup>, sheep<sup>13</sup> and pigs<sup>14, 15</sup>.

## **Rationale**

To gain a better understanding of the ecology and epidemiology of PoAstVs and to evaluate the evidence available for various aspects of causal inference a scoping will be conducted. To establish that an organism causes disease, requires evidence that can be difficult to develop. Reaching a judgment of causation requires a critical evaluation of the causal inference criteria. An example of the application of causal thinking to an emerging pathogen has been provided for Zika virus<sup>16</sup>.

## **Objective**

The objective of this study is to summarize published literature about prevalence, association, pathogenesis and type of diagnostic tools used for the detection of porcine astroviruses.

## **Methods**

### **Study design**

A scoping review will be conducted to provide an overview of porcine astroviruses. The scoping review will be focused on mapping of evidence about individual and herd-level prevalence,

associations with enteric, respiratory and/or neurologic disease in swine, pathogenesis and diagnostic tools used for the detection of astroviruses in swine.

### **Source population**

The source population will be peer reviewed manuscripts. In addition, the proceedings of the American Association of Swine Veterinarians (AASV), James McKean Iowa State University Swine Disease Conference, American College of Veterinary Pathologists (ACVP) conference, American Association of Veterinary Laboratory Diagnosticians (AAVLD) conference, Allen D. Lemman Swine Conference, Conference of Research Workers in Animal Diseases (CRWAD) and International Pig Veterinary Society Congress (IPVS) will be searched. The country of investigation, language and year will not be used as an exclusion factor.

### **Information source**

MEDLINE and Centre for Biosciences and Agriculture International (CABI) databases will be searched using Iowa State University (ISU) Web of Science interface. The country of investigation, language and year will not be used as an exclusion factor.

Reference lists of relevant manuscripts and the table of contents from the proceedings of the American Association of Swine Veterinarians (AASV), James McKean Iowa State University Swine Disease Conference, American College of Veterinary Pathologists (ACVP) conference, American Association of Veterinary Laboratory Diagnosticians (AAVLD) conference, Allen D. Lemman Swine Conference, Conference of Research Workers in Animal Diseases (CRWAD) and International Pig Veterinary Society Congress (IPVS) will also be searched for eligible studies.

The search will involve searching for the term “Astrovirus” only for the Swine Information Library (SIL) excluding Journal of Swine Health & Production (JSHAP) text and abstracts, web pages, and AASV news. For this resource the title will be screened, and if it appears relevant, the paper will be evaluated. Recent review manuscripts of Astrovirus will be examined for additional reports potentially missed by our database search. The bibliography of relevant manuscripts will also be assessed for relevant manuscripts.

### **Search strategy**

A proposed search strategy is listed in Table 1. The search will not be restricted by language or year (1864-2018, Nov-16).

Search Number	Search string	No of Results
1	TS= (pig OR porcine OR swine OR hog)	1,078,416
2	TS= (Astrovirus OR AstV OR AstVs)	2,405
3	#1 AND #2	152

Table 1. Proposed search strategy using the ISU Web of Science interface. Accessed on Nov 16, 2018

### **Study records**

### **Data management**

EndNote™ reference management will be used for storing Research Information System (RIS) files. The initial duplication will be conducted in EndNote™ and MS-Excel will be used to summarize all the data from relevant peer reviewed manuscripts.

### **Selection process**

One reviewer will independently read all abstracts/summaries identified from the search as shown in the Table 1. Full reports will be acquired if the reviewer identified the abstract as potentially relevant. Eligible studies will describe

- 1) individual and herd-level prevalence using surveys of any type,
- 2) associations with any disease in swine in case reports, case series, comparative studies,
- 3) pathogenesis of astroviruses in swine using observational or experimental studies,
- 4) or available diagnostic tools used for the detection of porcine astroviruses.

### **Data collection process**

Data extraction will be completed independently by one reviewer from all eligible manuscripts. One reviewer was used because it was considered unlikely, given the small number of studies to assess, that the reviewer would miss relevant papers.

### **Study level information**

The country where study was conducted, year of sample collection, type of study relevant to the question (prevalence, association, pathogenesis), pig age group(s), clinical signs, types of samples collected (feces, oropharyngeal, oral fluids, serum), environmental samples (pen, feeder, pit, hallway, load out chutes, etc.), number of samples tested, percentage of positive samples, types of diagnostic tools reported (PCR, *in situ* assays) and gross & histologic lesions will be



collected. As disease diagnosis commonly requires multiple diagnostic tools and eliminating differential diagnoses, information regarding sample type and applied diagnostic tests will be noted and if reports failed to justify the test hypothesis and/or support the conclusions made by the study, the report will be rejected based on logical fallacy.

For comparative studies evaluating association, we will evaluate the potential for valid causal inference based on Hills causal criteria. We will identify gaps in the ability to establish causal inference using this approach. For comparative studies evaluating association we would evaluate the risk of unbiased estimate of prevalence based on the approach used for sampling.

### **Outcomes and prioritization**

The primary outcome of interest will be prevalence or incidence, risk ratio, risk odds ratio, prevalence ratio, prevalence odds ratio and the secondary outcomes of interest include association with type of system involved, pathogenesis and type of diagnostic tools used for the detection of porcine astroviruses.

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