Clinical Management of Reproductive Problems in Dairy Cows

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ABSTRACT
Reproductive herd health programs are effective in maintaining and improving the reproductive efficiency of dairy herds resulting in increased net income. Unobserved estrus, ovarian cysts, conception failure, uterine disease, abnormal pregnancy, and observed abortions are common reproductive abnormalities in dairy cows that may be controlled effectively with improved management practices and appropriate administration of pharmacological and biological agents. Prostaglandin F2α is effective in the management of unobserved estrus, uterine disease, and abnormal pregnancy whereas gonadotropin-releasing hormone is a reliable treatment for ovarian cysts and may be useful to improve conception in repeat breeders. Incidence of uterine disease can be minimized by eliminating or reducing factors that predispose to retained placenta and appropriate treatment of affected cows. Immunizing agents should be selected for each herd based on risks of exposure to infectious diseases that cause infertility or abortion.

INTRODUCTION
Increases in size and intensity of management of dairy herds during the past two decades have increased the demand by dairy farmers for planned reproductive herd health programs as an aid in attaining more efficient reproduction. The relatively recent availability of new pharmacological agents, most notably prostaglandin F2α and its synthetic analogs (PGF) and gonadotropin-releasing hormone (GnRH), has improved the veterinarian’s ability to treat more effectively several reproductive diseases in dairy cows.

HERD HEALTH PROGRAMS
Many veterinary practices in dairy-producing areas of the United States offer some type of planned reproductive health program. Most are similar to those described by Allenstein (2), Cote (18), and Seguin (75) in which cows are examined at 2-wk or monthly intervals. Cows routinely examined during herd health calls are those that have calved from 14 to 45 d previously (postpartum examination), those that have been inseminated more than 30 d previously and have not returned to estrus (pregnancy examination), cows that have not been detected in estrus by the time of desired breeding or found to be nonpregnant at the previous examination (anestrus), and cows that have a history of an abnormality of the reproductive organs including ovarian cysts, metritis, retained placenta, pyometra, and dystocia. Other animals in the herd that might be examined are cows inseminated 20 to 23 d previously, heifers prior to breeding for the detection of congenital defects that might interfere with reproduction, and breeding soundness evaluation of bulls in herds practicing natural service.

Long calving intervals decrease milk production and income for the dairy producer (65). The economic losses due to milk production loss, replacement costs, additional breeding costs, veterinary services and medication, and reduced herd improvement in California dairy herds have been calculated (67). Minnesota researchers have estimated that up to $5.50 per cow per day is lost for each day that the calving interval exceeds 12 mo (70), although one reviewer suggested that an average calving interval of slightly longer than 12 mo may be more profitable in high-producing herds (20). Louca and Legates (53) found that milk production during the first lactation was increased by in-
creasing number of days open, whereas milk production during the second and third lactations declined with additional days open. They suggested that a calving interval of 13 mo for first lactation cows and 12 mo for second and later lactation cows as an optimum for attaining maximum production. One author (22) proposed that ideal reproductive indices, which must be achieved to maintain a 12-mo calving interval, are 80% first service conception, 1.3 services per conception, and a maximum of 85 d from calving to conception; however, more realistic goals for commercial dairy herds are likely to be 60% or greater first service conception, less than 1.8 services per conception, and a maximum of 100 d from calving to conception.

Most reproductive failure in dairy herds is due to deficiencies in management. The most significant benefit of a planned health program is the stimulation of improvements in management that decrease the interval from calving to conception due to improved estrus detection (13, 22).

Reproductive herd health programs increase the productivity and, thus, net income of participating dairy herds. Barfoot et al. (6) analyzed the effects of a preventive medicine program on milk production, cow fertility, culling rate, and cow and calf mortality when utilized at five acceptance levels. They found that the yearly cost of veterinary services per cow was more than four times higher ($35 vs $8) in herds responding maximally to the preventive program compared with herds using emergency veterinary services only. However, they concluded that an average or better management response to a comprehensive herd health program significantly improved net income. When management response to the herd health program was minimal, the farm's net income was greater than an emergency service system only if the cows were of exceptional value or if milk was sold to an exclusive market.

Galton et al. (32) studied the effects of a herd health program by dividing one herd into two groups. Half the herd received routine reproductive herd health examinations, and the other cows were examined on an emergency basis only. They demonstrated a significant net difference in favor of the herd health group of $58.40/yr.

Common reproductive problems encountered in dairy herds in the midwestern United States are failure to display or detect estrus (anestrus), ovarian cysts, conception failure or early embryonic death, uterine disease, abnormal or unwanted pregnancy, and observed abortions. The reported incidence of ovarian cysts, repeat breeders, and retained placenta is shown in Table 1.

**REPRODUCTIVE ABNORMALITIES**

**Unobserved Estrus**

Most dairy cows have normal ovarian cycles and first estrus by 50 d postpartum (17, 28). Failure to detect estrus is a major cause of infertility in dairy herds with twice as much time lost due to failure to detect estrus as is due to conception failure (7). For efficient estrus detection Foote (27) recommended that the herds person must be able to recognize multiple signs of estrus and proestrus, have sufficient time to observe all animals, and observe the herd for signs of estrus at least twice daily. Rates of estrus detection by twice daily observation vary with the skill of the observer and are reported to range from 50% (30) to 73% (17) with observers able to identify more accurately those cows showing strong signs of estrus (30). Aids to estrus detection such as hormone-treated steers and tail paint improve the rate of estrus detection (30). In one study (93), 90% of the cows with a history of failure to display estrus examined during routine herd health visits were found to have normal ovarian function while 10% had some abnormality that arrested the reproductive cycle. Errors in estrus detection may result in insemination of up to 20% of cows during the luteal phase of the cycle (28, 35) or insemination of pregnant cows (17).

Prior to the 1970's, a number of drugs and hormones were used to treat anestrus, but critical evaluation showed that none were superior to the prediction of the time of the next estrus by palpation of the temporary ovarian structures by an experienced examiner (93).

The demonstration that treatment of cows with a functional corpus luteum with PGF is followed by luteolysis and return to estrus in 2 to 5 days has prompted its widespread use in the treatment of nondetected estrus (74). The response to PGF varies with the stage of
TABLE 1. Reported incidence of reproductive abnormalities.

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Incidence (%)</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>Ovarian cysts</td>
<td>13.0</td>
<td>Bierschwal (9)</td>
</tr>
<tr>
<td></td>
<td>15.3</td>
<td>Britt et al. (15)</td>
</tr>
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<td></td>
<td>29.4</td>
<td>Hinze (41)</td>
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<tr>
<td></td>
<td>16.9</td>
<td>Kirk et al. (50)</td>
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<td></td>
<td>12 – 14</td>
<td>McKay and Thomson (57)</td>
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<tr>
<td></td>
<td>12.3</td>
<td>Morrow et al. (60)</td>
</tr>
<tr>
<td></td>
<td>11.2</td>
<td>Whitmore et al. (89)</td>
</tr>
<tr>
<td>Repeat breeders</td>
<td>11.9</td>
<td>Boyd and Reed (14)</td>
</tr>
<tr>
<td></td>
<td>5.0</td>
<td>Frankos (29)</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
<td>Hewett (40)</td>
</tr>
<tr>
<td></td>
<td>22.1</td>
<td>Pelissier (68)</td>
</tr>
<tr>
<td>Retained placenta</td>
<td>13.7</td>
<td>Curtis (19)</td>
</tr>
<tr>
<td></td>
<td>10.3</td>
<td>Erb et al. (25)</td>
</tr>
<tr>
<td></td>
<td>10.0</td>
<td>Frankos (29)</td>
</tr>
<tr>
<td></td>
<td>1.96</td>
<td>Moller et al. (58)</td>
</tr>
<tr>
<td></td>
<td>9.1</td>
<td>Muller and Owens (61)</td>
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<td></td>
<td>12.1</td>
<td>Pelissier (68)</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>Roine and Saloniemi (72)</td>
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</table>

the estrous cycle. Momont and Seguin (59) showed that cows treated with PGF on d 0 through 5 of the estrous cycle do not respond, and those on d 6 respond only occasionally. Responses on d 7, 8, 10, and 11 through the end of the cycle are 66, 91, 93, and 96%, respectively. Further, they demonstrated that treatment on d 7 or 8 was followed by estrus in a shorter and less variable time than was treatment on d 10. Similarly, Watts and Fuquay (85) reported that 95.6% of cows with an aged corpus luteum (d 11 to 16) responded to a single injection of PGF while only 59.3% of cows with a young corpus luteum (d 6 to 10) responded. The pregnancy rate in cows with an aged corpus luteum was 74% and that in cows with a young corpus luteum was 50%. However, Tanabe and Hann (83) were unable to demonstrate a significant difference in the response of dairy heifers treated with PGF on d 7, 11, or 15 of the estrous cycle. In most cases, it is not possible to determine the maturity of the corpus luteum by palpation, and variations in the response of PGF-treated cows should be anticipated.

Attempts have been made to reduce or eliminate the need for estrus detection by utilizing fixed time insemination following treatment. In some trials, fixed time insemination resulted in acceptable conception rates in cows (5) and heifers (71) while in others fixed time insemination was not successful (4); thus, insemination at 8 to 12 h after the onset of detected estrus after PGF treatment is preferred (59). If fixed time insemination is used, cows should be observed for estrus and rebred if they display estrus beyond 96 h after treatment.

Reasons for poor fertility following PGF-induced estrus have been described. Baishya et al. (4) demonstrated that PGF does not cause complete luteolysis in all cows. Jackson et al. (42) reported that 18% of cows treated with two injections of PGF failed to synchronize due to an extended period of low progesterone concentrations following the first injection and were unresponsive to the second injection. They found a similar period of low progesterone concentrations following normal estrous periods during which 64% of the cows conceived. They concluded that this apparent abnormality may not be a cause of infertility. Prostaglandin treatment of dairy cows with undetected estrus shortens the interval from treatment to first service and treatment to conception (23, 69, 76) but does not improve fertility (23, 69, 72, 74).
Seguin (77) described several methods by which PGF treatment can be used to reduce the time required for estrus detection and confine breeding to 4 d/wk or 13 d of a 21-d period. Schemes for estrous control utilizing a single dose of PGF require that a functional corpus luteum be accurately identified. The accuracy of rectal palpation in detecting the presence of a functional corpus luteum is reported to vary from 66 (23) to 95.5% (69). Cows that are pregnant must also be accurately identified, as treatment with PGF prior to the 5th mo of pregnancy results in a high incidence of abortion (90).

Although PGF may be used to control reliably the estrous cycle when administered properly, estrus detection and other management procedures related to high fertility are necessary for successful breeding. Synchronized breeding tends to concentrate the deficiencies present in the herd and PGF cannot be used as a substitute for good management (74). Education of those persons responsible for estrus detection is an important aspect in treatment of anestrus. Stevenson et al. (80) found that while insemination at standing estrus or mounting activity resulted in the highest pregnancy rates, more liberal interpretation of the signs of estrus may be beneficial.

Ovarian Cysts

Ovarian cysts arrest the normal ovarian cycle of dairy cows and are a significant cause of reproductive failure in some herds. Ovarian cysts are defined as follicle-like structures greater than 2.5 cm in diameter that persist for 10 d or more (10). Two types of pathological cysts are described, viz., follicular cysts, which are thin-walled and may be single or multiple on one or both ovaries, and luteal cysts, which have thicker walls due to partial luteinization and tend to be single structures. The majority of cows with ovarian cysts are anestrus, but some may show frequent or intense estrus.

The goal in the treatment of ovarian cysts is to induce luteinization of the cyst and reestablish normal ovarian cycles. Successful treatment of ovarian cysts has been reported with human chorionic gonadotropin and GnRH (10, 24). Most cows that reestablish ovarian cycles subsequent to GnRH administration exhibit estrus 18 to 23 d after treatment (10). The time from treatment with GnRH to estrus may be reduced to 12 d by administering PGF 9 d after GnRH (48).

The incidence of ovarian cysts is highest in the early postpartum period and spontaneous recovery occurs in some cases. By applying a decision analysis model, White and Erb (88) demonstrated that it is more economical to treat the condition with GnRH at the time of initial diagnosis than to wait for spontaneous recovery. They further determined that it is more economical to examine all cows for ovarian cysts at 45 d postpartum than at 30 or 60 d postpartum (87).

The prophylactic use of GnRH to reduce incidence of ovarian cysts has been reported. Britt et al. (15) administered GnRH between 8 and 23 d after parturition and found that fewer treated cows developed ovarian cysts or were culled for infertility than were untreated controls. The interval to first insemination and conception and number of services per conception were not different from controls. Zaied et al. (91) also reported that administration of GnRH at 12 to 14 d postpartum reduced the incidence of ovarian cysts and the number of animals culled due to infertility. Nash et al. (63) were unable to demonstrate a reduction in the incidence of ovarian cysts or uterine infections following the administration of GnRH on d 13 to 15 postpartum. Further, Etherington (26) reported that the administration of GnRH on d 15 postpartum resulted in a significant increase in the incidence of pyometra, pre-breeding anestrus, and interval from calving to conception in a herd with a high incidence of retained placentas and postpartum metritis.

Kirk et al. (50) recorded the incidence of ovarian cysts in a herd of 300 cows for 7 yr; 16.9% of the cows produced at least one daughter with ovarian cysts and two bulls had sired 17.6% of the daughters affected with ovarian cysts while siring only 11.6% of all daughters in the herd. These two bulls were removed from the breeding program. Although recognizing that progress would be slow due to the generally low heritability of the condition, Kesler and Garverick (47) suggested that incidence of the disease could be reduced by breeding only to bulls whose offspring have a low incidence of ovarian cysts and culling the daughters of cows that develop cysts.
Conception Failure and Repeat Breeders

A frequent complaint of dairy producers is that inseminated cows are found to be nonpregnant when examined at 30 to 60 d after breeding or that cows continue to return to estrus after having been bred. In the case of the nonpregnant cow, it is impossible to determine if the cow failed to conceive or if conception was followed by embryonic death.

Repeat Breeders. Tanabe and Casida (82) defined a repeat breeder as a cow that returned to estrus after a third infertile service, a minimum of one calving to exclude those with congenital abnormalities that prevent conception, less than 10 yr of age, absence of abnormalities of the genital organs detectable by rectal palpation, absence of abnormal genital discharges, and normal interestrus intervals.

Maurer and Echternkamp (56) reported that heifers from which abnormal or no embryos were recovered had a lower luteinizing hormone (LH) peak, a longer interval from the onset of estrus to the LH peak, and lower progesterone concentrations than did heifers from which normal embryos were recovered. They suggested that hormonal asynchrony may produce an undesirable uterine environment, which leads to infertility. Linares et al. (52) found that the incidence of abnormal embryos recovered from repeat breeder heifers was higher than in heifers of normal fertility.

In immature cattle, the causes of repeat-breeding in many cases appear to be temporary, but infertility in mature dairy cows may be permanent due to histopathological lesions of the genital tract caused by Corynebacterium pyogenes (21). Bulman and Lamming (16) reported that 12 of 14 repeat breeders included in their study eventually conceived and that four of five of these cows had good fertility the following year. O'Farrell et al. (64) found that cows culled as repeat breeders had a slightly lower fertilization rate than normal cows, but embryonic survival was normal if fertilization occurred. They suggested that errors in estrus detection contributed substantially to repeat breeding.

Attempts have been made to reduce the incidence of infertility due to conception failure by the administration of GnRH during the early postpartum period or at the time of insemination. Kesler et al. (49) found that a GnRH-induced LH release would not result in ovulation until 12 to 13 d postpartum. Lee et al. (51) administered GnRH on d 14 postpartum or at the time of insemination and improved conception rates. In addition, conception rates in repeat breeders increased by 35% following treatment with GnRH. Nakao et al. (62) reported that first service conception rates were improved by treatment with GnRH at the time of insemination in cows during their first and third lactations that were more than 101 d postpartum and had daily milk production of 26 to 30 kg. In their study, they found that GnRH treatment was more beneficial in areas where average fertility was low. Schels and Mostafawi (73) also reported that fertility was improved if GnRH was administered at the time of estrus. Stevenson et al. (81) found that treatment with GnRH at first insemination did not improve conception at that breeding, but conception was improved at subsequent services.

Embryonic Death. Cows in which early embryonic death occurs are often regarded as infertile since most embryo loss occurs early in the gestation period (3) and the cow returns to estrus at a normal interval. Bishop (12) suggested that many embryonic deaths are due to genetic abnormalities, are unavoidable, and should be regarded as the normal means by which unfit genotypes are eliminated to a low biological cost. Bearden et al. (8) observed that repeat breeding following service by bulls with histories of high fertility is usually due to embryonic death while repeat breeding following service by bulls of low fertility is due to both fertilization failure and early embryonic death.

Pregnancy diagnosis by slipping of the fetal membranes during rectal palpation has been suggested as a cause of increased embryonic death (1). Although these results have not been confirmed by other studies (84), the clinician should be aware that undue trauma during examination of the pregnant uterus is contraindicated.

Uterine Disease. Diseases of the uterus may be obvious to the dairy herd person if they result in retained placenta, metritis, cervicitis accompanied by an abnormal discharge from the genital tract, or septic metritis. Pyometra is characterized by accumulation of exudate within the endometrial cavity and suspension of the
estrous cycle due to failure of luteolysis. The cow with pyometra shows few, if any, clinical signs of the disease and the condition may not be recognized by the herds person unless the reproductive tracts of anestrus cows are routinely examined.

Nonspecific uterine infections have been suggested as a cause of infertility in clinically normal repeat breeding cows. Hartigan et al. (38) found that Corynebacterium pyogenes, the most common microorganism associated with bovine uterine disease, caused clinically detectable lesions but did not find evidence to support the contention that endometritis is an important cause of infertility. Hartigan et al. (39) examined 80 repeat breeder cows from 80 herds. A wide range of nonspecific bacteria were isolated from the uterus of 34% of the cows. Endometritis was observed in biopsies from 41% of the infected uterus and in 43% of the uninfected uterus; thus, they could not demonstrate a correlation between endometritis and uterine infection with nonspecific bacteria. Hartigan et al. (39) concluded that nonspecific infection is not an important cause of infertility in the repeat breeder cow.

Antibiotics are commonly infused into the uterus of cows suspected of having nonspecific uterine infections. Fuquay et al. (31) demonstrated that routine intrauterine treatment of cows with neomycin sulfate within 24 h after calving did not alter uterine involution and resulted in an increase in services per conception and days open. The intrauterine infusion of antibiotics results in residues in the milk from treated animals and guidelines for withholding time have not been established (11). Jernstrom (44) observed satisfactory conception rates could be obtained without the use of antibiotics if management practices were adequate.

Excessive contamination of the environment with pathogenic microorganisms results in infection of the reproductive tracts of cows during the 2nd and 3rd mo postpartum. Sanitary practices do not appear sufficient to prevent spread of infections, and isolation of cows with purulent discharges is recommended (37).

Currently, the treatment of choice for pyometra is PGF with 85 to 90% of treated cows responding with evacuation of the uterus within 3 to 9 d after treatment (34, 66). Endometrial lesions require about 30 d to resolve following evacuation. Prophylactic treatment with PGF at 20 to 30 d postpartum may result in improved reproductive performance, but treatment with PGF may be more effective when used only in those cows found to have uterine disease at the postpartum examination (26). Penicillin is the drug of choice as an antibacterial agent infused into the uterus following treatment with PGF since nitrofurazone causes a depression of fertility (66).

Cows that retain the placenta are more likely to develop uterine disease than are cows that do not (25). The etiologies of retained placenta are multiple and have been reviewed by Grunert (33), Maas (54), and Wetherill (86). Grunert (33) categorized the causes of failure of the fetal and maternal tissue to separate as follows: 1) immature placentomes, 2) edema of the chorionic villi, 3) necrosis between the chorionic villi and crypt walls, 4) advanced involution of the placentomes, 5) hyperemia of the placentomes, and 6) placentitis and cotyledonitis. Julien et al. (45, 46) demonstrated that retained placenta is associated with selenium deficiency in dairy cows and were able to reduce the incidence of retained placentas in commercial dairy herds from 51.2 to 8.8% by administering 50 mg sodium selenite and 680 IU alpha tocopherol acetate 20 d prior to parturition. Gwazdauskas et al. (36) treated cows with 21.9 mg sodium selenite; however, incidence of retained placenta was similar in both treated and control animals. Erb et al. (25) studied incidence and effects of retained placenta in a large herd for a 30-yr period. They reported that 10.3% of calvings resulted in retention of placenta. Twin calvings, abortions, and stillbirths were accompanied by a higher incidence of retained placenta. Further, cows retaining the placenta were more likely to develop genital abnormalities, but those cows that rapidly became normal following a retained placenta were as fertile as their herdmates. They concluded that in the absence of a subsequent reproductive abnormality, retained placenta has a minimal effect on reproductive performance.

Therapy for retained placenta varies from none to aggressive manual separation of the fetal membranes from the maternal tissue. Conservative treatment of retained placenta is generally recommended; however, the results of controlled studies of intrauterine treatment with tetracycline are conflicting. Squire
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(79) reported that the reproductive performance of cows with retained placenta that were treated with intravaginal tetracycline was similar to herdmates and better than affected cows that were examined vaginally. Conversely, Møller et al. (58) found that treatment with tetracycline reduced subsequent fertility and that normal conception rates could be expected if no medication were given.

Measures to reduce the incidence of retained placenta should include those directed at reducing or eliminating the etiologic factors listed by Grunert (33). These include a dry period of 6 to 8 wk, a properly balanced ration, exercise, reduction of stress, immunization when possible against infectious diseases that cause abortion, and attention to sanitation at parturition. Selenium supplementation should be considered in deficient areas.

Abnormal or Unwanted Pregnancy. Unwanted pregnancies are seldom encountered in dairy herds. When heifers are accidentally bred or cows mismated to an undesired sire, PGF reliably induces abortion prior to 150 d of gestation (90). A combination of PGF and dexamethasone is useful to induce abortion beyond 150 d of gestation (55).

Fetal mummification is occasionally encountered in dairy cows and is characterized by death of the fetus, failure of abortion, absorption of placental and fetal fluids, and persistence of the corpus luteum. Treatment with PGF is effective in expelling the mummified fetus within 3 to 5 d (43).

Hydrops of the fetal membranes is characterized by pathological accumulation of fluid within the uterus during the last trimester of gestation. The most common dropsical conditions in dairy cows are hydramnios and hydralantois. In severe cases termination of the pregnancy is necessary to preserve the life of the dam. In pregnancies complicated by hydrops, PGF has been successfully used to induce parturition (78).

In some cases, induction of parturition may be indicated in dairy cows that have excessive udder edema or when an oversized fetus is anticipated. A combination of PGF and dexamethasone reliably induces parturition within 72 h after treatment. Incidence of retained placenta is high following induced parturition but few complications are reported (55).

Abortions. A number of microorganisms are known to cause infertility and abortion in dairy cows. Most herd health programs include an immunization schedule designed to reduce the impact of infectious diseases common in the area (92). The choice of immunizing agents varies with the management of the herd. Animals in closed herds are less likely to be exposed to infectious diseases than are animals in herds that purchase replacements. In herds that utilize natural service by bulls, immunization against campylobacteriosis is justified but is superfluous when only artificial insemination is used. Rodents that are common carriers of leptospirosis are nearly impossible to eliminate from the environment of dairy cows; thus, twice yearly immunization against all available serovars should be considered in all dairy cows. An immunization schedule utilizing modified live virus vaccines must be designed to meet the needs of each herd. Some modified virus vaccines are approved for use in pregnant animals while others are not. Animals that are eligible for immunization against brucellosis are defined by statute in many states, Immunizing agents must be used as directed and should not be expected to replace good management practices. When abortions are observed, the assistance of a diagnostic laboratory should be sought to diagnose the cause.

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