FAQ SHEET

What are the keys to eradicating *Streptococcus agalactiae* in dairy herds?

Streptococcus agalactiae (often called '*Strep ag*') has been extensively studied since research in the 1930s showed it was possible to eradicate infection from herds by culling and segregation (Bramley and Dodd 1984). Despite the fact that its transmission is well understood and the bacteria is highly sensitive to commonly used antibiotics, *Strep ag* remains a significant cause of mastitis and milk quality problems in Australian dairy herds.

The bovine strain of *Strep ag* is highly adapted to the udder and is only found in the mammary tissue, milk or on the skin of recently milked teats. It does not normally grow in other environments and will only survive for a limited time (see table below).

Recent gene mapping studies have supported the accepted mechanism of spread from cow-to-cow at milking: *Strep ag* isolates within herds had similar or identical patterns while the patterns between herds were quite distinct (Baseggio *et al* 1997). In contrast, other streptococcal species (*Strep uberis* and *Strep dysgalactiae*) and *Staphylococcus aureus* had more complex and diverse patterns within herds.

Strep ag is introduced to herds when infected cows are milked with 'clean' cows. Typically this occurs when cows with unknown udder health status are purchased or when cows from other farms are milked temporarily with a clean herd. Large field studies have shown heifers are unlikely to be a significant source of *Strep ag* infection (Fox *et al* 1995), although early reports did demonstrate the potential for infection to spread between calves when infected raw milk was fed to calves and they cross-suckled each others teats (Schalm *et al* 1971).

Control of *Strep ag* can be daunting because infection spreads rapidly between cows if the milking hygiene, milking routines or milking machine performance is less than optimal. However, this should not be discouraging because the bacteria can be *eradicated* from herds by implemention of a good management plan – a feature that sets it apart from other infectious causes of mastitis.

This Technote gives a guide to diagnosing *Strep ag* in herds and describes practical ways of implementing eradication measures. It follows the general approach to a mastitis investigation described in the flow chart in the revised Technote 13 (February 2003).

Features of *Strep ag* that make it possible to eradicate from farms:

- The bacteria is readily identified in infected herds;
- It is an obligate parasite of the udder;
- It is highly susceptible to many antibiotics;
- It has simple mechanisms of transmission that are thwarted by good mastitis control management; and
- Susceptible cows can be protected by isolating them from infected cows.

If you are investigating a mastitis problem, also read revised Technote 13 (February 2003) which contains a Mastitis Investigation Pack to help you collect, collate and prioritise information.

Survival of *Strep ag* in different materials (Becker 1994)

Material	Survival time
Hands and clothes of milkers	Up to 10 days
Skin of cows after contact with milk containing *Strep ag*	About 14 days
Milk fat	14 – 21 days

Describe the presenting problem

The first step in investigating and resolving a mastitis or milk quality problem for a herd is to describe the problem as the farmer sees it.

Strep ag infection in herds often presents as high bulk milk cell counts or high clinical case rates. For example, in a recent study of Victorian herds Phueketes *et al* (2001) detected *Strep ag* in milk from 60% of vats with bulk milk cell counts above 400,000 cells/mL.

Strep ag infection should not be automatically ruled out in herds with low bulk milk cell counts or low clinical case rates. Bulk milk cell counts may be low when infection has only recently been introduced to the herd or when the rate of new infection is offset by treatment or culling of infected cows. Some seasonally calving herds have normal cell counts at the start of each season that 'creep up' as the lactation progresses. Herds with high prevalence of *Strep ag* infection can also have low clinical case rates, even with efficient clinical mastitis detection (Barkema *et al* 1998).

Elevated Total Plate Counts or Bactoscan readings are seen in some *Strep ag* herds because large numbers of streptococcal bacteria can be passed to the bulk milk by small numbers of infected cows.

Define the problem as *Strep ag* by obtaining milk culture results

The next step is to establish that *Strep ag* is a cause of the farm's mastitis or milk quality problem. Milk culture results are required from sufficient cows to determine whether *Strep ag* is present in the herd. It is important to have at least 20 effective milk culture results (excluding "no growth" and contaminated samples).

Technote 4.3 describes how to collect milk samples for culture and reasons for milk samples yielding 'no growth'.

Strep ag is usually easy to culture from quarters with clinical mastitis provided samples are collected prior to any antibiotic treatment and the cultures are not overgrown by other bacteria (contaminants). All new clinical cases should be sampled and it is useful to review any milk culture results available from clinical cases that occurred before the investigation began.

In herds with predominately subclinical infection, the best chance of diagnosing *Strep ag* is by taking milk samples from cows with individual cell counts above 250,000 cells/mL. This is possible only in herds that have milk recording data. An alternative approach is to identify cows to sample by measuring milk electrical conductivity or doing Rapid Mastitis Tests. The veterinarian supervising this step in the investigation should choose the cows to sample, rather than leave the selection to the farmer. It is advisable to select a range of cows: a mix of age groups including heifers, a mix of animals with recent and persistent elevations in cell count, and those with peak cell counts ranging from 300,000 to over a million.

When collecting samples to diagnose *Strep ag* in herds:

- A single composite sample is as useful as four individual quarter samples; and
- Samples can be collected either before or after cows have been milked.

– Dinsmore *et al* 1991

If the selected cows are kept as a group after a milking, sample collection can be completed 2-3 hours later, or immediately before the next milking, rather than during the milking process. ✔

In many herds with mastitis or milk quality problems due to *Strep ag,* a large number of these milk samples will yield the bacteria. Even a single isolate of *Strep ag* is pertinent because the bacteria originates only from the mammary tissue or milk of infected cows.

Mastitis bacteria other than *Strep ag* that are isolated from the milk cultures provide important clues about the mechanisms of spread operating on the farm and likely responses to treatment. For example, treatment outcomes for cows infected with concurrent infections of *Strep ag* and *Staph aureus* are less likely to be successful because of the udder damage and micro-abscesses that the latter causes.

The number of viable *Strep ag* in milk samples from subclinically infected quarters is not affected by freezing for six weeks. Samples that have been stored in the freezer should be kept frozen during transport because each freeze-thaw cycle reduces the likelihood of obtaining a useable culture result.

– Murdough *et al* 1996 ✔

What happens in the laboratory

A number of streptococcal species cause mastitis, so pathogens must be typed to the level of *Streptococcus agalactiae* and not just reported as *Streptococcus* species.

Streptococci grow on blood agar plates as 1-2 millimetre, smooth, translucent colonies. More than 80% of bovine strains of *Strep ag* are surrounded by a narrow zone of complete (beta-) hemolysis – although they can be non-hemolytic or show a zone of greenish discolouration (alpha-hemolysis). To differentiate between the species, colonies are picked off for further biochemical tests. *Strep ag* is CAMP test positive, esculin negative and does not ferment inulin (Claxton and Ryan 1993). A number of other non-esculin splitting colonies can be mistaken for *Strep ag* by the unwary (Biggs 1996).

Activate your advisory team

Where to find support

- Consider consulting with a mentor if your local team has limited experience in *Strep ag* herds.
- Countdown-L provides a means to connect with other experienced advisers.
- Check the Countdown website www.countdown.org.au for contact details of advisers who have completed Countdown training.

With *Strep ag* problems, solutions usually require the expertise of more than one profession. For example, the milking machine technician must investigate machine function and suggest priorities if changes to equipment are required to help reduce the risk of spreading bacteria. The roles of the veterinarian include arranging and analysing milk cultures and supervising treatment strategies. Herd improvement staff organise milk recording data. The dairy company field officer plays an important part in estimating financial outcomes for farmers (and sometimes helping to maintain income for farms likely to incur penalties for poor milk quality) and in planning for any antibiotic residue testing required.

Advisers are strongly recommended to use a team approach so that the expertise from each professional is co-ordinated and the farmer receives a consolidated report with consistent recommendations. The farmers and staff on many farms struggling with *Strep ag* are under a lot of stress and interaction with a co-ordinated group of advisers markedly increases the chance of them resolving the problem.

Collate and assess findings with the advisory team

Antibiotic cure rates for *Strep ag* are high, but they are not 100%, so there is no chance of permanently resolving a *Strep ag* problem unless the factors that allow spread to occur on the farm are corrected. To stop spread of the bacteria from cow to cow, milk from infected cows must not come in contact with the teats of clean cows. Throughout the investigation the advisory team must look for the factors that are critical to stopping spread and eliminating current infections on the farm.

The keys to eradicating *Strep ag* from a herd are to:

- Stop spread of the bacteria from cow to cow
- Eliminate the bacteria from infected quarters

Use the Investigation Master Sheet in revised Technote 13 (February 2003) to prioritise factors that are contributing to *Strep ag* problems on individual farms.

Stop spread of the bacteria from cow to cow

Important areas to review when stopping spread of bacteria from cow-to-cow include:

- teat disinfectant preparation and application;
- milking machine performance;
- milking routines;
- hygiene with clinical cases;
- segregation of infected cows; and
- the herd's introduction policy.

Teat disinfectant preparation and application

To control the spread of *Strep ag* it is essential to disinfect all teat skin of every cow at every milking. If any step in mixing the teat disinfectant solution is likely to be unsatisfactory or inconsistent (for example, water quality is likely to change or staff have difficulty mixing to protocol), consider a 'no risk' approach such as changing to ready-to-use product. Using glycerine emollient to 10% is often of benefit to improve teat skin condition.

Revised Technote 7 (February 2003) describes ways of achieving effective teat disinfection after every milking.

Although teat spraying is quick and used in most Australian herds, teat dipping provides more certain coverage of the whole surface of all teats. Some experienced advisers in the United States insist that clients attempting *Strep ag* control use teat dipping rather than spraying, especially in large herds. This may require a 2-3 week acclimatisation period for cows that are unused to having their teats touched.

Milking machine performance

The performance of the milking machine is critical in *Strep ag* problems. Liner function, vacuum level and pulsation should leave teats smooth, soft and supple after milking. Quarters should be completely milked out within the expected time.

Revised Technote 25 (February 2003) gives guidelines for assessing milking-time machine performance tests.

The 'Liners' FAQ sheet (February 2003) explains how to tell when liners need changing.

Any machine-related teat damage that does occur heals relatively quickly so re-scoring teats at 2-3 week intervals helps to check corrective actions made to the machines.

Technote 6 and revised Technote 9 (February 2003) give guidelines for assessing completeness of milking, milking times and teat condition.

The *Countdown Downunder Farm Guidelines for Mastitis Control* give a checklist to help farmers achieve a good milking routine (Guideline 5) and good hygiene in the shed (Guideline 8).

Milking routines

Milking routines should be both consistent and appropriate. Assess the opportunity for cup slip and 'impacts' (droplets of milk that are projected back against the end of the teat as a result of air entering the teat cup). Pay special attention to cup removal: cups should fall free of teats because the vacuum has been cut to the claw and vacuum should *never* be broken at the mouthpiece of one or more teatcups.

Hygiene with clinical cases

In *Strep ag* herds it is highly desirable to milk clinical cases as a separate group. Any alternative requires *extreme* vigilance to be confident that hygiene is at a level that stops spread and will be very complex to maintain.

Ensure milkers are wearing clean gloves and taking additional steps to wash them after checking the quarters of suspect cows.

Segregation of infected cows

Segregating cows into temporary 'clean' and 'infected' groups is a very powerful tool for minimising exposure of uninfected cows to milk from infected cows. The objective is to progressively move cows out of the infected herd, by cure or culling, until *Strep ag* is eradicated. Some farms are able to do this, but others are not able to fit it into their overall management. Keys to making it a success include:

Effective classification of 'clean' and 'infected' cows

All clinical and subclinical cows – even those with only one subclinically infected quarter – must be in the infected group. If the clean group includes infected cows, all the benefits can be eroded.

The initial split of the herd is an important step with classification usually based on culture status, individual cow cell count, age and treatment history or a combination of these. If cell counts are used, consider applying a low threshold (for example 150,000 cells/mL) to reduce the risk of misclassifying infected cows, although this has a side-effect of increasing the number of clean cows allocated to the infected group.

One method of segregating herds, especially in large herds with high prevalence of infection, is to only allocate cows to the clean group once they have calved after a dry period where they had antibiotic Dry Cow Treatment. Heifers join the clean group when they calve.

It is essential to have clear rules for demoting cows. Any clinical cases that occur, and all cows that develop high cell counts, must be immediately removed from the clean group. Cows may be held in an interim group and cultured to establish their actual status, or they may go directly into the infected group.

Cows with subclinical *Strep ag* infection pass bacteria intermittently in their milk and do not have consistently high cell counts at all stages of their infection (Biggs 1996) so a single milk culture or cell count will not correctly identify the *Strep ag* status of all individual cows in a herd.

A method of improving diagnostic accuracy for individual cows is to collect milk samples weekly for 3 weeks and class cows as infected if *Strep ag* is found in at least two of the three samples (Griffin *et al* 1977). This is usually limited to research studies due to the labour and cost involved.

The physical capacity to cope with at least two groups of cows

The farm must be able to cope with at least two groups of cows – and more during calving periods when colostrum mobs are also required. The groups are likely to be quite different in size so consideration needs to be given to available paddock sizes, the set-up of laneways, and the ability to manage different grazing pressures. Large herds often find this an easier proposition because they are already set up to run different groups of cows.

The clean group must *always* be milked first and the milking machine must be washed after the infected group has been milked.

A very robust cow identification system

If cows from the infected group become co-mingled with the clean group they must be able to be identified and removed before milking.

A dual identification system with a strong visual component is important, for example hock and ear tags with different colours allocated for the two groups (not red/green because this is difficult for colour-blind people to distinguish). If the farm uses electronic identification with audible signals in the dairy, it is worthwhile setting it up so that a warning signal occurs if a cow enters in the wrong group.

Good staff understanding of why the system exists and how it works

There is always extra work in running two groups so all staff must be focused on success.

The herd's introduction policy

Ensure that no cows that could be carrying *Strep ag* are brought into the herd. Instituting a purchase protocol outlined in Farm Guideline 21 is an important long-term factor for success on these farms.

Eliminate the bacteria from infected quarters

Important areas to review when eliminating the bacteria from infected quarters are:

- dry cow management and treatment strategy;
- the herd's culling policy;
- detection and treatment of clinical cases; and
- antibiotic treatment of subclinical infections during lactation.

Dry cow management and treatment strategy

Most existing infections can be cured using effective antibiotic treatments – particularly at drying-off. Blanket Dry Cow Treatment strategy is recommended for *Strep ag* herds. Ensure that all cows (other than those to be culled) are treated with Dry Cow Treatment in all four quarters at drying-off.

Technote 17 gives practical pointers for administering Dry Cow Treatment and ways of minimising associated problems such as antibiotic residues.

The herd's culling policy

Strategic culling of persistently infected cows is also important to remove infection from the herd. Not all *Strep ag* cows will cure, so it is important to cull cows with infections that persist from one lactation to the next despite Dry Cow Treatment in the intervening dry period. (These cows can only be identified in herds that are regularly milk recording.) Cows with palpably fibrosed udders are also less likely to respond to treatment and should be considered for culling.

Technote 15 explains the basis for culling recommendations.

Although cows with a short history of very high cell counts often attract the farmer's attention on milk recording reports, there is usually no rationale to cull these cows as many will cure with treatment.

Detection and treatment of clinical cases

Technotes 4 and 10 describe how to find, treat and record clinical cases.

Strep ag herds often have high rates of clinical disease, with many cases having clots visible in foremilk or at the teat end after cups are removed. Early detection and treatment enhances cure rates and reduces the risk of spreading *Strep ag*. A protocol for finding and treating clinical cases should be established for the farm and followed by all workers in the dairy.

Antibiotic treatment of subclinical infections during lactation

Antibiotics are sometimes used to treat subclinical infections during lactation as this is one way to reduce the number of infected quarters in the herd. After culls have been removed and cows in late lactation have been dried-off, there are often infected cows in early or mid lactation to consider. The objective of treating during lactation is to reduce the cell counts of these cows and minimise the number of bacteria that they are shedding.

CAUTION

Some farmers see antibiotic treatment as a quick-fix solution to *Strep ag* problems but there are always some infections that do not cure, so never 'blitz' until the cause of spread of *Strep ag* in the herd has been determined and resolved. It is very dispiriting for the whole team to be back in the same situation next year after a major treatment exercise.

The decision to treat cows with subclinical infection during lactation is a complex one. The key questions are:

- Have all of the factors causing spread of the bacteria been found and sustainably corrected?
- Can the farm deal with logistic challenges such as the administration of antibiotic to a large number of cows, disposal of waste milk and avoidance of antibiotic residues?
- Will there be a financial benefit? This is usually based on the difference between the costs of the exercise (primarily the cost of antibiotics and lost income because of discarded milk) and the likely gains (from higher payment for milk of lower bulk milk cell count and possibly increased production). Dairy company staff can provide milk income estimations, and the team advising the farm must judge how much change in cell count and production is likely to be achieved. Consideration of cash flow is also important as there is a high initial cost.

Your advisory team must be reasonably confident of a positive answer to these questions to recommend treatment during lactation.

Having decided to go with lactational treatment, the choices are to use 'blitz therapy' (treating all cows in the herd) or 'partial blitz therapy' (treating selected cows or selected quarters). The herd must have a specific treatment plan supervised by the veterinarian in your team and include the dairy company adviser, especially to plan for antibiotic residue testing.

The details of the treatment plan must cover:

Selecting which cows or quarters to treat

Most treatments are directed at treating all four quarters of selected cows. The approach to selecting cows to treat is essentially the same as classifying cows to segregate (see page 6).

Selecting which antibiotic to use

Typical cure rates of *Strep ag* infections to most antibiotics formulated for mastitis, especially the penicillins, are above 90%. Some antibiotics are much less effective, with more than 80% of *Strep ag* strains being resistant to neomycin or streptomycin (Becker 1994).

Technote 4.4 lists the published cure rates for *Strep ag* with various antibiotics.

The withholding period for a particular product often influences the choice of product to use. A full course is recommended.

Intramammary preparations have been used almost exclusively until recently. Some experienced practitioners now prefer a course of injectable treatment with penethamate hydroiodide (which achieves high levels of penicillin in the udder) for two main reasons – it is easier and quicker to administer to a large number of animals, and there are no hygiene problems associated with poor intramammary administration technique.

Checking milk for inhibitory substances

Be warned that in some herds inhibitory substances have occurred well beyond product label withhold periods after blitz or partial blitz treatments, especially with intramammary treatments. These events have made milk discard times difficult to predict and manage.

Technote 4.10 describes antibiotic residue tests.

Bulk milk from treated cows must be tested for inhibitory substances before it is included in the vat for sale. Most routine screening tests are microbial inhibition tests such as the Delvotest SP (DSM Food Specialists). Positive test results may be due to antibiotic residues or to non-specific inhibitory substances known to be present in freshly calved cows or clinical mastitis cases (Cullor *et al* 1993). Nevertheless, these screening tests constitute the buying standard for many dairy companies and milk for sale must be test negative.

With prior arrangement with the dairy company, samples can be sent for routine screening at the last milking of the withhold period, and for subsequent milkings until negative results are obtained.

Assessing responses to treatment

Approximately 2 to 3 weeks after treatment it is important to arrange a milk recording visit so that cows that still have elevated cell counts can be identified and sampled for milk culture. Cows that continue to excrete *Strep ag* may then be targeted for culling or milking in a separate group.

Develop a farm plan to eradicate *Strep ag* with the farm team

Although there are many common issues in *Strep ag* infected herds, the detail of the control plan for each farm is unique. The most appropriate strategy must take into account factors such as the herd size, calving pattern, the prevalence and chronicity of infection in the herd, the stage of lactation when the problem is diagnosed, the shed type, farm layout and most importantly, the staff involved and their ability to cope with different approaches.

Field experience world-wide has shown that the key to controlling *Strep ag* is having all farm staff keen to succeed and able to adopt the changes necessary to routine management. The best outcomes occur when all staff understand the issues involved and are active in designing their own action plans that specify what has to be done, who does it and when it happens. This is subtly but crucially different from staff agreeing to detailed plans designed by the advisory team.

Example notes to a farm team

Dear Joe, Michael, Maria and Dave

Your 'milk through' cows – whether they are autumn calvers or empties – represent a huge risk of transmitting new infections to cows you have cured with antibiotic Dry Cow Treatment.

Here are some options for you to discuss at your planning session next week.

Option 1: Keep milking 'milk through' cows, but as a second group until they are dried off

Good option but a lot of work to do properly. Need to regard this group as infected.
Allows for the few dry cows in your herd that did not get antibiotic Dry Cow Treatment.
Must clearly identify the 'milk through' cows eg different coloured ear tag and leg band.
If any of these cows get in with the main herd they must not be milked but cut out.
MUST maintain this group until they have had antibiotic Dry Cow Treatment. Likely to be Nov/Dec for empties and Feb/Mar for autumn calvers.

Option 2: Sell all 'milk through' cows

Sell all these cows and shut down dairy (for 1-2 weeks).
Stops accumulation of penalty points for poor BMCC at factory.
Most likely to be successful but very expensive.

Option 3: Treat all 'milk through' cows during lactation

This involves treating all cows when numbers are lowest (and also treating the few dry cows that did not get antibiotic Dry Cow Treatment when they calve).
Milk withholding periods may be extended. Milk collection can resume once a negative test is achieved on bulk milk by the factory.
Dealing with contaminated milk is a difficult issue (it must not be dumped in the environment).
A spot herd test and some cultures 2-3 weeks later would be necessary to help identify cows that didn't respond.
Non-responders and some cows with poor udder conformation would need to be sold.

One successful approach to developing a plan has been built around two farm meetings that involve all staff (and are typically held over lunch at a venue away from the farm). At the first meeting one of the advisers explains the underlying principles of *Strep ag* control, the key findings of the investigation and some options for the farm. A second meeting a few days later is then dedicated to the farmer and staff establishing their own plan for implementation. The adviser is present here too, but as a mentor rather than designer. This approach requires the on-farm team to be active rather than passive in the design of their eradication plan, exposes misconceptions and gaps in understanding, and is more likely to achieve a plan that is practical and can be implemented on that farm.

A farm goal, a timeline and rewards for everyone on specific achievements are important to define. The action plan for the farm is then documented and displayed where everyone can see it (for example, as a whiteboard), and tasks ticked off as they are completed.

Monitoring

Farms undertaking eradication of *Strep ag* need to monitor progress – especially of 'clean' groups of cows which have been segregated or treated – to get early warning of re-emerging problems. New infection rates (inferred from Individual Cow Cell Counts) provide a guide. The sentinel cows are those with no cell count above 250,000 cells/mL during the current or previous lactation. Field experience indicates that fewer than 1% of these animals should convert to infected status (with a cell count of over 250,000 cells/mL) each month.

Cultures of milk samples from all new clinical cases, and preferably also from cows that have new high cell counts in subsequent months, provide an important insurance policy.

A number of methods of monitoring vat milk are possible.

- Bulk milk cell counts are the easiest to obtain and are available on a daily basis for most farms. Each farm must set clear triggers for action and re-assessment by the advisory team. Examples of triggers include an upward trend in bulk milk cell counts over 4-8 weeks, a spike of more than 20% increase, or a bulk milk cell count exceeding a specified threshold. If clean and infected groups are being milked separately, but into the same vat, collection of a sample after the clean group is milked and before the infected group is started can also provide a guide to the status of the clean group.
- Bulk tank cultures are accepted as a valid screening test for *Strep ag* although the sensitivity of bulk tank cultures in low prevalence herds is not known (Corlett 1995).
- Regular bulk milk tests using polymerase chain reaction (PCR) techniques are not currently available in Australia, but in the future they may be useful to determine herd status for *Strep ag* (Phuektes *et al* 2001).

'Vat milk tests' FAQ sheet describes the use of serial sampling to detect *Strep ag* in vat milk

Review progress

It is important to ensure that elements of the farm plan that must be completed quickly are started and followed through. This gets the effort 'off the ground' and allows some rapid changes to be seen by the farmer and staff. For example improvements in teat condition can be quite rapid and will give a guide to the effectiveness of changes to machine function that have been implemented.

Regular review of key outcomes such as bulk milk cell counts and clinical case rates by advisers can help pick triggers. With the farmer's permission, data from the dairy company or herd improvement may be sent directly to one of the advisory team.

Herds that have *Strep ag* problems often have a number of management issues to address which require focus and dedication from staff. Individual components can be inadvertently overlooked or reduced in priority. The farm plan should include scheduled visits from advisers to assess progress and help refocus activities. Encouragement for achievements is also important.

On-going interaction with advisers is particularly important to help keep focus in farms with year-round milking systems. Experience has shown that these herds are less likely to succeed in eradicating *Strep ag* because they do not have the opportunity to reduce the herd prevalence to a low level through administration of Dry Cow Treatment to all cows at one time.

Field experience has repeatedly shown that it is possible to eradicate *Strep ag* from Australian dairy herds. Farms that have a workable plan and regularly monitor their situation can expect to succeed.

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Notes